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TO: Peter Louie
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RE: EWA DSS
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A few comments on your paper. If the EWA really is one of the main features of Stage 1, we need to start thinking about what we really need to make it real. Your paper has really moved us forward.

In general I very much support the direction you are going in. Gaming to date has been much too inefficient to allow the kinds of analysis we need. We cannot test alternative hypotheses, we cannot run large numbers of years, we have trouble reconstructing what we did, and we have a difficult time evaluating the impacts of our actions. A more automated model can help with all of these and will help us operate better once we begin implementation of the EWA. My main concern has to do with the human element. I view the problem of operations as being too complex to be captured by a computer program, at least for some time to come. Thus, I want to assure that our programming provide support to the EWA designers and operators, to help them learn, forecast, and operate. I don't think that we can expect the program to do more than inform and suggest.

USES OF THE MODEL

We have many uses for our upgraded model. The model needs to be designed to support them all. Off the top of my head, I would identify them as follows:

1. LEARNING

Test general strategies. We need to be able to do batch runs where we look at various priorities, trigger points, and operational strategies over a large number of years to get some insight into the benefits and costs generated by various operational approaches. You discuss this in your paper. In this mode, the model would be learning tool. It would not resolve conflicts over science. Different groups should be able to operate the model and evaluate the results based upon their own view of the science. Thus, we should be able to operate the model to support a positive QWEST for that faction, to support reductions in direct mortality for another faction, to emphasize dry year flow enhancement for for one group, to reduce wet year salvage for another group. In this mode, the model is not really an expert system, though it might help us design one or more expert systems. In this mode, many variables must be parameterized. We should be able to modify operational patterns as a function of species, date, species location, total population, past salvage patterns, assumed salvage forecast assumptions, EWA funding, assets, projected assets, location of assets, hydrological forecasts, the cost of water, instream flow targets, etc. That is, doing the job right is very difficult. We might be able to start with something simple, then become more complex over time. As the model becomes better at incorporating the various variables that go into decisionmaking, it can become a better foundation for developing operational priorities. For each set of priorities (e.g., USFWS beliefs about the science), the model eventually becomes an expert system. However, there can never be a single expert system as long as we disagree about the science, about the relative priority of species, or even operational priorities (e.g., the use of groundwater vs water purchases).

Russ's model can already do this to some extent. For example, we can introduce salvage trigger levels that force reductions in exports, or allow for increases in export pumping. However, the model does not make many of the other decisions that we would wish to study (e.g., water purchase and storage strategies, debt carryover strategies, upstream flow enhancement).

While this type of model would be very useful as a way to test out possible operational approaches, to help structure the basic rules of thumb for the EWA, and to estimate the needed suite of EWA assets, it will not be more than a crutch for planners for a long time to come. The system is simply too complex to rely on this type of tool for more than some insight into how rules affect outcomes.

2. OPERATIONS

We also need a realtime mode, for use by actual operators. In this mode, we would not run the model in a batch mode over a number of years, but would examine possible futures over the next few months or years in several dimensions: the implications of possible current decisions across the spectrum of possible hydrological and biological futures. This then becomes a sort of Monte Carlo analysis. Given that we make a certain decision today (and otherwise continue to operate into the future according to our expert system), what are the possible outcomes, expressed probabilistically. This type of analysis could become computationally very demanding, since the number of permutations is effectively infinite. However, I am sure that techniques exist to bring the problem down to manageable size.

Thus, for example, we could assess the benefits vs the risks associated with reducing export pumping to 5 kcfs vs 8 kcfs on a given week. By moving to a 5 kcfs regime, we get an immediate increase in current protection, but the expected value of EWA assets will drop as a result, which will reduce the EWA's ability to take advantage of future environmental enhancement opportunities or to take on debt. This would tend to reduce the internal discount rate on benefits which the biologists have applied to date in the gaming (i.e., they have depleted EWA accounts for medium sized benefits at the risk of losing opportunities for much larger benefits in the future.). Again, I doubt that we would ever be able to have enough confidence in the model to simply accept the outcome. But the outputs could be very instructive and could help operators to avoid major misallocations in resources.

3. LEARNING

We need to be able to walk through a sequence of years, month by month as we do now. If nothing else, it is an extremely good way to teach how the system operates and how the EWA can provide benefits.

SPECIFIC MODEL WEAKNESSES

You have identified some of the weaknesses in Russ's daily model. I wanted to flag one more. The daily model does allow for interaction between Delta operations and upstream operations. Upstream operations remain too simplistic, at least for project reservoirs. This will hamper our ability to use the model to work on upstream flow enhancement.

The daily model starts from daily storage and release patterns. Then, if greater upstream releases are required to meet local instream flow, the model releases extra water. As far as I know, the model never reduces releases below baseline levels until reservoirs reach their minimum storage levels (although we can make such changes by hand in the spreadsheet). But, in general, changes in Delta operations are not reflected upstream. Consider a baseline in which San Luis fills early. After filling, the operators will base their upstream release patterns on preserving storage upstream. But if the EWA knocks down SLR storage, the operators will adjust their operations to send upstream storage across the Delta whenever the transfer efficiency is high. The model doesn't do this and causes operational distortions. For example, look at March of 1993.

Perhaps we could extract the operational rules curves from CALSIM and insert them into this model. Ideally, I suppose, CALSIM would be modified to allow realtime operational shifts. It would probably be a more widely accepted engine than Russ's daily model.

SPECIFIC COMMENTS

Are you looking at creating a model which operates both for the projects and the EWA? (e.g., CALSIM modified to incorporate the EWA). Or one which takes an operations run and then imposes EWA actions on top (such as the daily model). The former seems to be implied by your discussion of water supply operations on page 5. This is clearly the best way to go, but, unless we could modify CALSIM for this purpose, probably very expensive.

Under "fish and environmental protection" on page 5, I think that you would need to add consideration of the state of the account. If the EWA is flush with water and money, it should be more protective, because the real benefits of an action are more likely to be above the opportunity costs of the assets. If the EWA is strapped for water and money, it must be more conservative, since expected value of the opportunity costs is higher. Similarly, if projected runoff is high and EWA confidently expects San Luis to fill, it can be more liberal.

WATER QUALITY

Your discussion of optimizing water quality would most easily be applied to a basic project operations model (e.g., an enhanced CALSIM). That is, it would be easier for the Projects to operate for optimal quality than to expect the EWA to carry out this function. Indeed, much of your discussion of needed models seems to apply to basic Project operations tool needs as much as to the EWA. I continue to resist the idea that water quality enhancement should be an explicit goal of the EWA for institutional reasons. The closest we could come would be to assign values to changes in water quality and charging the EWA for degradataions (and rewarding it for improvements). That is, we could internalize the costs of its actions. But to do more is to confuse the mission of the EWA.

ACCOUNTING

Remains very problematic. We can probably do an accounting in the modelling as you suggest by using baselines. However, we will need to translate our accounting system into real operations when EWA comes to life. Without an operational baseline, but a dynamic baseline which reflects past EWA actions, accounting becomes more murky. I think that we can do it for exports without too much difficulty using seasonal accounting as I have described. I am still uncertain that we have solved the upstream problem. For example, we must be able to keep track of a situation in which San Luis would have filled using surplus flows, but now is filled using stored flows because of EWA cuts. The EWA has no debt in San Luis (since it filled), but clearly owes water upstream. Perhaps the amount is equal to the amount of EWA debt in San Luis that was extinguished using stored upstream water. This can probably be quantified.

PERFORMANCE MEASURES

I think that another performance measure must be opportunity costs. We only know how valuable an action is by comparing that action to other actions which might no longer be affordable because the proposed expenditure of assets. That is, at the margin, is it better to spend a dollar or an acre-foot for a particular action or is it better to (1) spend it right now on a different action or (2) save the money or water for use in the future. This kind of analysis will require a Monte Carlo type analysis as discussed above. Without it, we have no guidance other than intuition on the appropriate balance between current and future benefits.

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